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ABSTRACT

This document reports the findings of a survey-based descriptive assessment study undertaken in 1977 to obtain systematic feedback on the magnitude, nature, and effectiveness of instructional computing as it is being employed on the University of Iowa campus. Included in the report are a description of the survey procedures employed, an overview and introductory comments, demographic data, and an analysis of the perspective of faculty members on instructional computing. This last section provides faculty statements of relative value, subjective evaluations of instructional benefits, and other observations based on judgements of faculty members employing computer supported instruction. (Author/JEG)

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INSTRUCTIONAL COMPUTING AT THE UNIVERSITY OF IOWA: A DESCRIPTIVE ASSESSMENT

Prepared by the
Staff of the
Computer Assisted Instruction Laboratory
and
The Division of Instructional Services

Weeg Computing Center
The University of Iowa
Report Series 19/8

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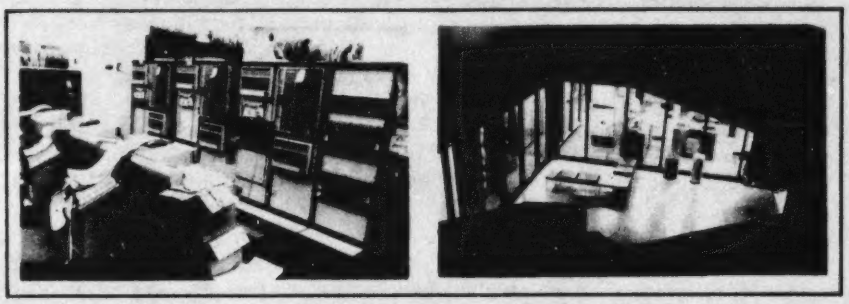
INSTRUCTIONAL COMPUTING AT THE UNIVERSITY OF IOWA: A DESCRIPTIVE ASSESSMENT

INTRODUCTION

Academic computing at The University of Iowa came into existence approximately twenty years ago with the establishment of the first identifiable computing facility on campus. The initial impact of academic computing on instruction was most likely concurrent with the establishment of this facility. Without doubt instructional computing has been steadily growing for over fifteen years. In the academic year 1972-73, with growing faculty approval and use of computer technology in instruction, a major thrust was launched on this campus to enhance and enlarge the University commitment to instructional computing. The year 1973 saw the acquisition of the first of four H-P time-sharing systems, the establishment of the CAI Lab in the University Computer Center, and the reconfiguration of the Division of Academic Computing (now the Division of Instructional Services) within the present Weeg Computing Center.



Weeg Computing Center at The University of Iowa.

Along with a continuing growth in faculty acceptance and use of computer technology in instruction, facilities supporting instructional applications have been enhanced and new facilities added. Among these are the addition of the terminal communication unit and the CYBER 70/71.

Given this degree of involvement and level of support in instructional computing, it has become increasingly desirable to obtain some systematic feedback on the magnitude, nature, and effectiveness of this instructional technology as it is being employed on The University of Iowa campus. Accordingly, a survey-based descriptive assessment study was initiated during the spring semester of 1977. This document reports the findings of that survey but is in no way the first feedback on instructional computing at The University of Iowa; however, it is the most complete and systematic to date.

This report consists of three sections and three appendices.* This section, consisting of a description of the survey procedures employed along with an overview and introductory comments, is followed by a demographic data section. The final section of the report is based on the perceptions of faculty members, including faculty statements of relative value, subjective evaluations of instructional benefits, and other observations based on the judgments of faculty members employing computer supported instruction.

*The appendices have been provided under separate cover.

Description of Survey Procedures

The data in this report are based on a two-stage survey of faculty members at The University of Iowa. An initial contact survey was mailed out to each faculty member. The purpose of this form, among other things, was to identify those faculty members who had made use of computing in their teaching during the last two years. Faculty members, so identified from a return of this survey form, received a second form which requested additional detailed information concerning their use of computing in instruction (see Appendix A). Of the initial 1,361 survey forms mailed, 832 (61%) were returned by the faculty. Of this number 198, or 23% of all responding, indicated that they had employed instructional computing within the past two years. Provision was made on this initial form to allow faculty members to indicate the number of courses in which they used instructional computing. The second form was mailed to the 198 faculty members who indicated a use of instructional computing. Multiple copies of this form were mailed to those who indicated the use of instructional computing in more than one course.

Data from the two survey forms were entered into files on the CAI Lab H-P system, constituting the data base from which the remainder of this report has been generated.

Survey Scope

The scope of this survey-based study and of this report is limited to those applications providing direct support of instruction. This definition of scope is in no way intended to disparage the contribution of more indirect or supportive applications. Instructional opportunities growing out of research uses of computing and support of professional functions removed from the direct instructional process are viewed as important and, no doubt, have a significant impact on the overall quality of instruction at The University of Iowa. However, these applications were deemed beyond the scope of the present report.

Responses from the faculty were, by and large, complete and legible. However, the data bases employed in preparing this report have been augmented through a sharing of information which was collected for the preparation of a report in the Office of the Vice President for Educational Development and Research.

Specifically, data acquired by Dr. Robert Ontjes have enabled us to provide a more accurate and complete picture of course enrollments and the frequency with which courses are taught.

Appendices

Appendix A* consists of sample copies of memos, survey forms and reminder cards employed in the survey. Appendix C is based on survey form B and consists of course data on courses which employ computer support of instruction. The data grouped by academic department or division within which the courses are offered. The departments or divisions are presented in alphabetical order. Specific data consist of course number, course title, the frequency with which the course is offered (number of sessions per year), the year in which computer support of instruction was initiated within the course, and enrollment figures. In addition, the course numbers within divisions or departments have been broken down by level: That is, below-100, 100-200, and above-200 level. Student enrollments for each year, and the number of student credit hours are also provided. The number of student credit hours is based on the student enrollment by semester credit hours per course.

*The appendices have been provided under separate cover.

Data contained in Appendix C is presented in greater detail in the section titled "Demographic Data." Appendix B consists of faculty responses to three items on Form B.

The three items 3, 9, and 10, on Form B read as follows:

3. Briefly describe your views of computing in this course.
9. What is the single most important benefit of computing in this course?
10. What is the most serious problem or hindrance to your use of computing in this course?

All responses for each item were categorized by content. Each faculty member's responses to all three items are presented sequentially in Appendix B. The responses have been ordered from 1 to 11 by category number based on item 9. Subheadings give the department or division within which each course is offered. The data in Appendix B are presented in more detail in the section titled "Faculty Perspective on Instructional Computing."

The data from this survey suffer from the "selective return" biases common to all questionnaire data. No unique or instrument-specific sources of bias have been observed.

DEMOGRAPHIC DATA

Of the 832 faculty members who responded to Form A, 198, or 23.8%, indicated that they used instructional computing in their teaching. These 198 members of the faculty employ computer support of instruction in courses which are spread through 58 academic departments or divisions. Table 1 presents an alphabetized list of these departments, along with the number of courses in each department employing computer-supported instruction. A breakdown of instructional computing users by faculty rank indicates a fairly consistent level of usage across the professorial ranks, as shown in Table 2. In the ranks of professor and department head, and in the rank of instructor, the absolute numbers are significantly smaller. It seems possible that this may be due in the first case to the press of administrative responsibilities. The lower absolute number of instructors employing computer support of instruction is difficult to interpret, as it may be based on a higher total percentage of returns of Form A, differing teaching responsibilities, or, most likely, lack of control in determining major innovations within the context of a course. The percentages given in Table 2 are the percentage of the number responding by category rather than the percentage of the total number using instructional computing. Table 3 provides an expansion of the users by rank data given in Table 2 by adding the dimension of mode of use. The categories of batch, interactive, or both are not mutually exclusive. It is of interest to note that 68.2% of the users employ batch applications, while 59.6% employ interactive applications. A further examination of Table 3 reveals that those who employ batch applications only constitute 34.3% (or 68) of the users, while those employing interactive only constitute 24.8% (or 51) of the users. Table 4 presents the same data as contained in Table 3 with the exception that the levels are broken down on the basis of years at The University of Iowa rather than by professional rank.

TABLE 1
DEPARTMENTS EMPLOYING CAI WITHIN COURSES

DEPARTMENT	# OF COURSES
Accounting	4
Business Administration	15
Business Education	5
Chemistry	3
Computer Science	14
Counselor Education	3
Dental Hygiene	1
Economics	5
Educational Psychology, Measurment & Stat	4
Education	1
Educational Administration	2
Elementary Science Education	2
Elementary Education	1
Engineering - Electrical	1
Engineering	2
Engineering - Chemical	2
Engineering - Energy	12
Engineering - Industrial	3
Engineering - Information	5
Engineering - Environmental	1
Engineering - Material	5
Engineering - Systems	10
English	1
Geography	5
German	4
History	1
Home Economics	1
Hospital and Health Administration	4
Internal Medicine	5
Journalism	3
Law	1
Library Science	1
Linguistics	1
Mathematics	6
Musics	12
Nursing	1
Operative Dentistry	1
Pathology	3
Pharmacy	8
Physical Education	4
Physics and Astronomy	6
Political Science	22
Preventive Medicine	6
Psychology	4
Recreation Education	1
Science Education	1
Secondary and Elementary Education	1
Secondary Education	2
Secondary Education - Mathematics	2
Social Studies Education	1
Social Work	2
Sociology	2
Speech Pathology & Audiology	5
Spanish and Portuguese	1
Speech and Dramatic Art	3
Statistics	9
Support Services	1
Urban and Regional Planning	2
TOTAL NUMBER OF DEPARTMENTS - 58	TOTAL 232

TABLE 2
INSTRUCTIONAL COMPUTING USERS BY FACULTY RANK

RANK	NUMBER RESPONDING	NUMBER INDICATING COMPUTER USE	PERCENT OF RESPONDENTS
Professor - Head	8	4	50.0
Professor	286	63	22.1
Associate Professor	226	64	28.0
Assistant Professor	237	56	23.6
Instructor	76	11	14.5
Total	832	198	24.0

TABLE 3
INSTRUCTIONAL COMPUTING MODE BY FACULTY RANK

Rank	Total #						
Prof & Head	4	1	25.0%	2	50.0%	0	0.0%
Prof	63	44	69.8%	41	86.1%	26	41.3%
Assoc Prof	64	42	65.6%	33	51.6%	14	21.9%
Assist Prof	56	39	69.6%	35	62.5%	21	37.5%
Instructor	11	9	81.8%	7	63.6%	6	54.5%
Total	198	135	68.2%	118	59.6%	67	33.8%

TABLE 4
INSTRUCTIONAL COMPUTING MODE UTILIZED BY FACULTY IN RELATION TO YEARS AT THE UNIVERSITY OF IOWA

Years at UI	Total #	—Batch—		—Interact—		—Both—	
1	24	13	54.2%	16	66.7%	7	29.2%
2	15	12	80.0%	13	86.7%	10	66.7%
3	24	18	75.0%	14	58.3%	9	37.5%
4	12	5	41.7%	9	75.0%	4	33.3%
5	16	10	62.5%	5	31.2%	2	12.5%
6	9	8	88.9%	4	44.4%	4	44.4%
7	12	9	75.0%	6	50.0%	4	33.3%
8	11	8	72.7%	8	72.7%	5	45.5%
9	10	8	80.0%	3	30.0%	1	10.0%
10	14	11	78.6%	7	50.0%	6	42.9%
11	7	6	85.7%	5	71.4%	4	57.1%
12	7	5	71.4%	6	85.7%	4	57.1%
13	7	4	57.1%	3	42.9%	0	0.0%
14	4	1	25.0%	3	75.0%	0	0.0%
15	2	1	50.0%	1	50.0%	0	0.0%
16	6	4	66.7%	3	50.0%	1	16.7%
17	1	1	100.0%	1	100.0%	1	100.0%
20	4	2	50.0%	4	100.0%	2	50.0%
22	2	1	50.0%	2	100.0%	1	50.0%
23	3	1	33.3%	2	66.7%	0	0.0%
25	1	1	100.0%	0	0.0%	0	0.0%
27	1	1	100.0%	0	0.0%	0	0.0%
30	1	1	100.0%	1	100.0%	1	100.0%
31	2	2	100.0%	0	0.0%	0	0.0%
36	1	1	100.0%	1	100.0%	1	100.0%
41	2	1	50.0%	1	50.0%	0	0.0%
Total	198	135	68.2%	118	59.6%	67	33.8%

TABLE 5
RELATIVE USE BY SYSTEM

	N	%
IBM 360	148	74.7
HP 2000	81	40.9
CYBER 71	12	6.1
OTHER	15	7.6

Table 5 shows the relative use of the IBM 360, the H-P 2000 systems, the CYBER 71, and other systems on campus. In conjunction with Table 4 it is interesting to note that, in terms of total applications, the IBM 360 is still by far the most heavily used system. In addition, in interpreting the 6.1% figure shown for the CYBER it must be borne in mind that these data were collected during the spring and summer of 1977. The relative newness of the CYBER system is in part reflected in this percentage loading.

Interactive and Batch Applications

In Table 5, based on a sort not shown, it is interesting to note that of the "interactive only" applications, the H-P systems have 35, while the IBM 360 carries only 13. Of the "batch only applications, the IBM 360 has 66 while the H-P systems have only four. A "batch only" application on an H-P system is a surprising categorization within itself. From examination of these four individual courses, it becomes apparent that the users are employing the H-P to get at the IBM 360, and, due to the nature of the application on the 360, they have categorized their use as batch even though the H-P terminal is interactive. Table 6 presents a break-down of application types across four major categories

Users at East-Hall remote, where batch use as well as interactive applications are made by faculty and students from such areas as Education and Psychology.

of CAI. No total figure is given for Table 5, inasmuch as these are not mutually exclusive categories, and one application can, as the students move through the application, exhibit two or more of the application types. Nevertheless, Table 6 does provide an indication of the relative use of the application types. It is not surprising that tutorial has the lowest percentage of utilization. Simulation and problem-solving are both influenced in an upward direction due to the relatively large number of applications which are mathematical in nature. It is interesting to note that problem-solving is still the most heavily used of these application types by a wide margin at 50.4%.

TABLE 6

APPLICATIONS
ACROSS MAJOR AREAS OF CAI

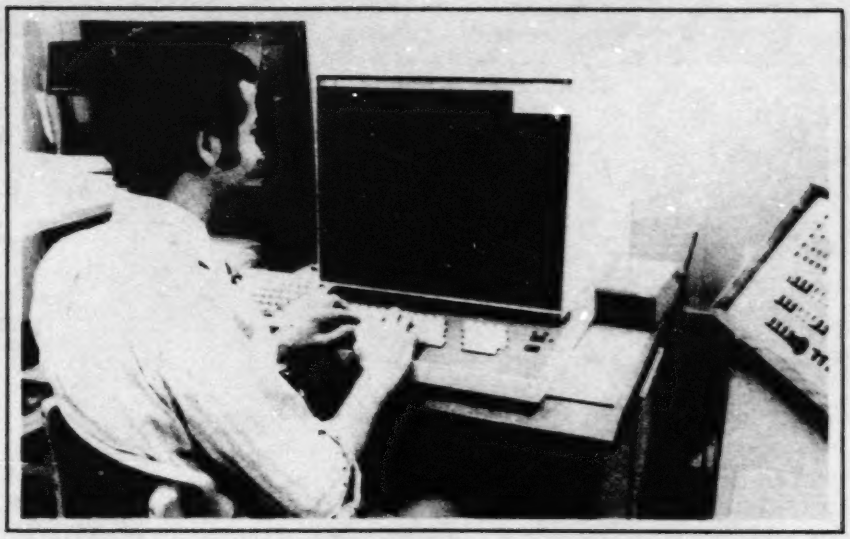
	N	%
Simulation	60	25.6
Problem Solving	117	50.4
Drill & Practice	40	17.2
Tutorial	18	7.7

TABLE 7
COURSES EMPLOYING INSTRUCTIONAL COMPUTING
BY COURSE LEVEL

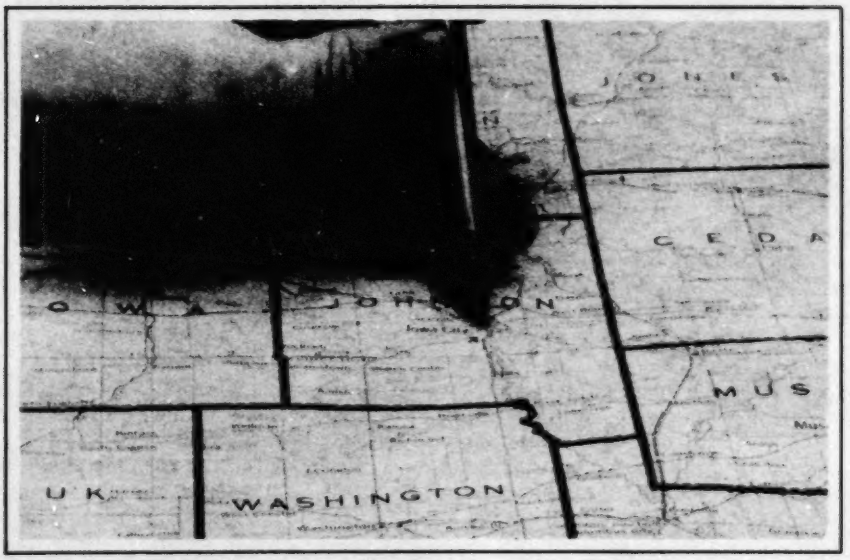
Course Level	Number of Courses	% of Total Courses by Level	Student Credit Hours	% of Total Student Credit Hours
Under 100	59	26%	38,982	65%
100-200	98	43%	12,610	21
Over 200	75	32%	8,146	14

Courses Utilizing Instructional Computing

Table 7 presents a breakdown of courses employing instructional computing by course level. In addition to the number of courses, the number of student credit hours by level is arrived at by multiplying the enrollment in each course by the number of credit hours for that course. When student credit hours are considered, rather than number or percentage of total courses utilizing instructional computing, an interesting shift takes place toward the under-100 level courses, showing 65% of the total; and while the 100-200 level courses constitute 43% of the courses, they constitute only 21% of the student credit hours generated. While the survey data on which this table was based cover a period of two years, the frequency with which the course is taught has been taken into account, hence generating data for one year only. A number of faculty members indicated courses taught in alternate years. In those cases frequency was entered at .5 to give a one-year average of the two years. There is some uncertainty about the data in this table because a number of faculty members did not indicate the credit hours associated with their courses. According to The University Catalog, a number of these courses were listed as varying from one to six credits. For all such courses, three credit hours were entered for purposes of computing the values, as shown in Table 7.



A staff member of the Department of Geography edits on the PDS-4. The files created on this system can be edited by using the digit program package which was developed by the Department of Geography. Over one-third of the utilization of this graphic display system comes from departments other than geography, including such diverse fields as theater, physiology, dance and engineering.



The input for the digitizer system is created by placing a sonic pen on the point to be digitized. Microphones along the x and y axis pick up the coordinates and input this information to the system.

7

TABLE 8
YEAR IN WHICH INSTRUCTIONAL COMPUTING WAS INSTITUTED

Year	Number of Courses	Percentage of Courses	Percentage of Courses Which Are Batch
Before 1970	10	7.5%	70%
1970	9	6.7%	44%
1971	3	2.2%	33%
1972	23	17.7%	65%
1973	11	8.2%	54%
1974	15	11.2%	27%
1975	19	14.2%	26%
1976	25	18.7%	32%
1977*	19	14.2%	47%

*Data are not complete for 1977 due to time of survey.

TABLE 9
COMPUTER APPLICATIONS IN RESEARCH AND PROGRAM WRITING

	Use in Research		Have Written A program	
	N	%	N	%
Use computers in instruction	181	91.4	140	70.7
Do not use computers in instruction	308	48.7	165	26.1

Faculty Utilization of Computers

Table 8 gives a breakdown of new computer applications by the year in which they were instituted, beginning with a multi-year category of pre-1970. The table then runs from 1970 through 1977. It should be noted that the data for 1977 are partial, due to the timing of the assessment survey. It is of interest to note the decline of the percentage of new start-ups which run in the batch mode, from a high of 70% in the period before 1970, down to approximately 25% of the courses for the years 1974 and 1975. For the years 1976 and 1977 this percentage is seen to be increasing, hopefully reflecting a deliberate and reasoned choice between batch and interactive instructional applications. In interpreting this table, it should be borne in mind that only 134 Form B's gave a date for which instructional computing was instituted in the course. Since we have 58% of the courses showing some start-up information, perhaps one of the most interesting points to be gleaned from this table is that a number of courses, whose application of instructional computing was instituted some years ago, continue to be taught employing computer support of instruction. This argues strongly for the faculty members' perception of the usefulness and desirability of instructional computing. The relatively high percentage of forms not supplying any date as to when instructional computing was instituted within the course unfortunately makes this date less clear-cut than one would desire.

The final table in this section, Table 9, is based on a two-way classification of faculty members' use of academic computing. On the one dimension, faculty members are classified on the basis of use or nonuse of computers in instruction. On the other dimension, two separate classifications have been made. The first is on the basis of those who do, as opposed to do not, use academic computing in their research. The second classification is on the basis of those who have, as opposed to those who have not, written a computer program. Table 9 also suggests what many people in academic computing observe on an informal basis--namely, that those who are users of computing are likely to be users of multi-application types. As can be observed in Table 9, of those who use computers in instruction, 91.4% also employ computing in their research. Only 47.7% of those responding who do not use computers in instruction use computing in their research. A similar trend can be observed for those who have written a computer program, with 70.7% of those who employ computers in instruction having written a program and only 26.1% of those who do not employ computers in instruction having written a program. While one cannot make arguments of directionality from data of this sort, there is strong suggestion that, once one becomes knowledgable concerning computing, one tends to find multiple applications of the technology.

FACULTY PERSPECTIVE ON INSTRUCTIONAL COMPUTING

Seven items on Form B ask the faculty members to provide a constructed response or a rating of relative importance or effectiveness of computer support of instruction. This section deals entirely with those seven items. Because this section is based heavily on judgmental information derived from the faculty responses, it is, in our opinion, the most interesting, substantial, and worthwhile data from this assessment survey.

Professor Dorsey Ellis of the College of Law uses a computer simulation of civil procedures which he developed in cooperation with Dr. Judy Edwards, former Associate Resident Scientist in the CAI Laboratory.

TABLE 10

Responses for the question: "What is the single most important benefit of computing in the course?"

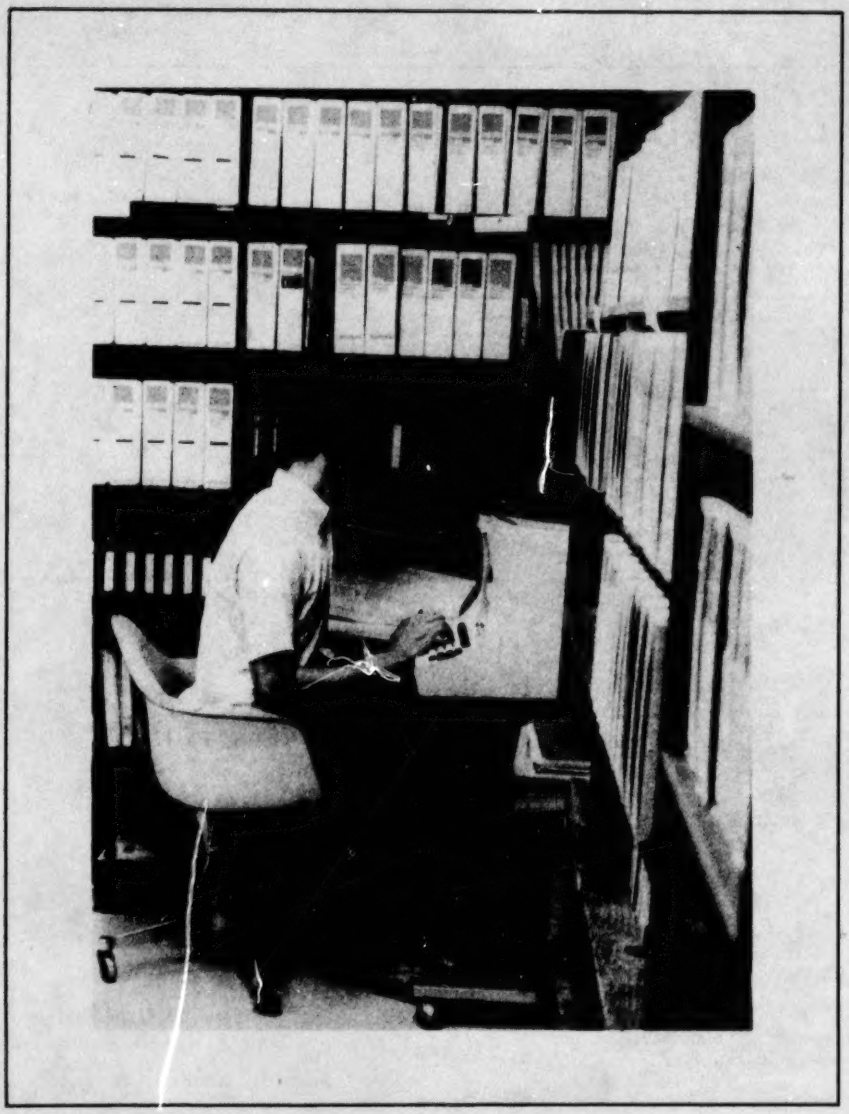
Category	Number	Percent	Response
1	47	21.6	Use or availability of statistical and data analysis packages
2	59	27.0	Number or variety of problems or data available; comprehensive or realistic problems; practical experience
3	44	20.2	Students become familiar with computer (General knowledge of computers - applications in a specific area)
4	23	10.6	Students learn a computer language or gain programming experience (Computer Science type)
5	18	8.3	Save student or instructor time; provides computer access at convenient times
6	25	11.5	Provides drills, repetition, feedback, reinforcement during learning -- individualization
7	17	7.8	Provides relief from manual computation, less time on machines and calculators
8	12	5.5	Provides course management; record keeping; CMI
9	30	13.8	Illustrates applications or principles; encourages discovery; stimulates class discussion; promotes individual problem solving and/critical thinking
10	19	8.8	Other
11	25	11.5	No answer

TABLE 11

Responses for the question: "What is the most serious problem or hindrance to your use of computing in this course?"

Category	Number	Percent	Response
1	29	13.3	Too much time, or lack of time, to develop courseware or software
2	36	16.5	Lack of equipment; inadequate number of terminals or other equipment; long waiting time for terminals; out of date equipment; need new equipment; lack of disk space
3	5	2.3	Equipment failure; terminals not in good repair; machine downtime
4	25	11.5	Lack of courseware or software; small or no data base; inadequate software
5	4	1.8	JCL, prompts, or other set-up requirements are too complicated
6	26	11.9	Students or faculty inadequately prepared or not familiar with computing, terminals, statistics
7	7	3.2	Lack of, or poor, documentation; poor communication; poor or inadequate UCC support
8	25	11.5	Equipment inconveniently located; terminals not located nearby
9	29	13.3	Poor turnaround or response time
10	32	22.1	No problems stated
11	28	12.8	Other
12	32	14.7	No answer

Respondents were asked to indicate the most important benefit and the most serious problem relating to the use of computing in each course. Nine benefit and nine problem classifications emerged from the analysis. Tables 10 and 11 show the the percentage of respondents who indicated each benefit or problem. Percentages do not total 100% as numerous responses were classified within more than one category. As is shown in Table 11, one respondent in four indicated that no problems were encountered. Study of Table 10 reveals that the primary perceived benefits are in three areas: (1) availability of problems on the computer, (2) availability of statistical and data analysis packages, and (3) the opportunity to become familiar with computing. Table 11 reveals a number of problems, the primary one relating to the unavailability of equipment. This is reflected directly in the second item, and also in Number 9 relating to turnaround and response time.



The College of Dentistry utilizes a computer-based system for keeping track of patient records.

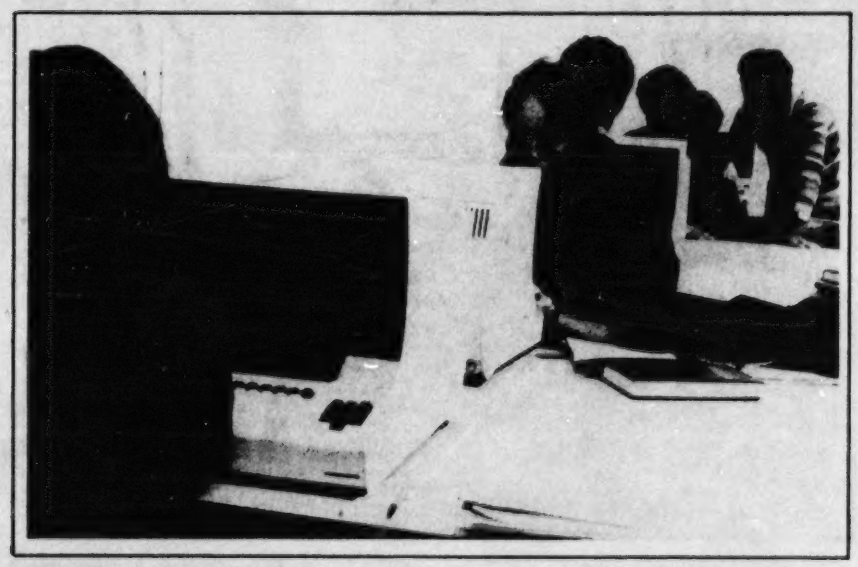
TABLE 12

Responses to the Question: "What prompted you to institute computing in this course?

Category	Number	Percent	Response
1	117	83.7	Course objectives include computing; computing required to meet objectives of course
2	9	4.1	Received development grant; attended CAI workshop; received prodding by instructional technologist; suggested by someone else
3	21	9.6	Computing instituted by others; used computing in other courses or in previous institution
4	22	10.1	Availability or ease of use of software, courseware, hardware
5	44	20.2	Improve my teaching; individualized instruction; course management; record keeping
	15	6.8	Student interest in computing
7	20	9.2	Own interest; subject suited to computer involvement
8	17	7.8	Other
9	31	14.2	No answer

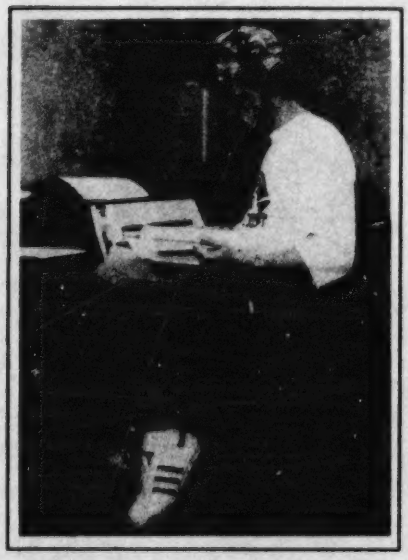
TABLE 13
FACULTY VIEWS OF THE RELATIVE IMPORTANCE OF RESEARCH AND PUBLICATION AS COMPARED TO INSTRUCTIONAL IMPROVEMENT

Compared to Research and Publication, the Importance of Instructional Improvement is:	Estimation of Colleagues Views		Own Views	
	N	%	N	%
Much Lower	76	32.2	20	8.6
Lower	80	34.3	32	13.7
Same (or no response)	62	26.6	122	52.4
Higher	13	5.6	50	21.5
Much Higher	3	1.3	9	3.9
Mean		2.1		3.0



Students in Business, Mathematics and Engineering utilize the computer in conjunction with their undergraduate programs.

Each faculty member who used computing was asked the reason why computing was instituted in the course (see Table 12). The majority indicated either that the course was already concerned with computing or that course objectives were modified to require computing, e.g., "to update the course to reflect computer applications in political science research." The second major reason computing was instituted was to improve teaching in some way. This reason was given by one out of five respondents. A complete listing from which Tables 10, 11, and 12 were derived is given in Appendix B. The reader is urged to browse through Appendix B to gain a fuller appreciation of the flavor of the comments reflected in Tables 10-12. Item 11 of Form B asks the faculty members to estimate the overall effect of computing on the quality of the course. The categories, on a 5-point scale, ranged from "much better" to "much worse." With "much better" given a value of 5, the mean rating on this item was 4.25. The percentages of those responding by category were: "much better," 40%; "better," 48.3%; "don't know," 9.5%; "worse," .9%; "much worse," 1.3%. While one can regret the two percent or so in the lower two categories, it can be seen that on the whole the faculty give the computer a very high rating for its effect upon the quality of instruction in their courses. Item 12 asked the faculty to characterize the role of computing in their course as "integral," "supplemental," or "incidental." The percentages responding in each category were: "integral," 43.5%; "supplemental," 46.2%; "incidental," 10.3%. When these items are considered together we see that the overwhelming majority of the responding faculty view instructional computing as a means of improving the quality of instruction and having a definite place within the structure of the course. The final table in this section is based on items 16 and 17 of Form B. Item 17 asked faculty members to rate instructional improvement compared to research and publication. A 5-point rating scale ranging from "much lower" to "much higher" was employed. Item 16 asked for the faculty member's perception of his colleagues' rating of the same comparison. Table 13 gives the frequency and percentage of response for each category on each of these two items. As can be seen from Table 13, faculty members employing computer support of instruction rate the relative importance of instructional improvement noticeably higher than their estimate of their colleagues' rating of the importance of instructional improvement. One need not discuss the accuracy of these faculty perceptions, for regardless of their accuracy, for the faculty involved, these perceptions constitute "reality."



A student in political science utilizes off-line materials in conjunction with a CAI program.